POPULATION ESTIMATES FOR PEARY CARIBOU (MINTO INLET HERD), DOLPHIN AND UNION CARIBOU, AND MUSKOX ON NORTHWEST VICTORIA ISLAND, NT, JULY 2001

Northwest Territories Environment and Natural Resources

POPULATION ESTIMATES FOR PEARY CARIBOU (MINTO INLET HERD), DOLPHIN AND UNION CARIBOU, AND MUSKOX ON NORTHWEST VICTORIA ISLAND, NT, JULY 2001

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ABSTRACT

A stratified strip transect aerial survey was conducted in the area north of Minto Inlet and west of the Shaler Mountains, northwest Victoria, NWT to document the numbers and distribution of caribou (*Rangifer tarandus*) and muskox (*Ovibos moschatus*) during 16 to 21 July 2001. We observed a total of 254 non-calf and 71 calf caribou on transect giving estimates of 1,271 ± 384 (95% CI) non-calf and 355 ± 152 (95% CI) calf caribou in the survey area. Approximately 20.9% of the caribou observed were calves. Overall, there were 0.035 non-calf caribou per km^2 in the survey area. The survey area included the range of the Minto Inlet Peary caribou herd (*Rangifer tarandus pearyi*) and the northwestern portion of the range of the Dolphin & Union caribou herd (*Rangifer tarandus*).

We observed 41 non-calf and 13 calf caribou on transect giving estimates of 204 ± 103 (95% CI) non-calf and 65 ± 59 (95% CI) calf caribou within the range of the Minto Inlet Peary caribou herd. Approximately 23.5% of the caribou observed were calves. Non-calf population estimates for 1998 and 2001 were not significantly different. However, a comparison of mean population estimates for these years suggest that the herd may have gone through a period of recovery during 1998 to 2001.

We observed 213 non-calf and 58 calf caribou on transect giving estimates of 1067 ±371 (95% CI) non-calf and 291 ±141 (95% CI) calf caribou within the range of the Dolphin & Union caribou herd in the survey area. Approximately 20.5% of the caribou observed in this area were calves. The

number of non-calf caribou in this area increased significantly between 1998 and 2001. These data indicate continued use of the area immediately west of the Shaler Mountains north to the area between Richard Collinson Inlet and Glenelg Bay by the Dolphin & Union caribou herd.

We observed a total of 3,850 non-calf and 494 calf muskoxen on transect giving estimates of 19,282 ± 3,221 (95% CI) non-calf and 2,474 ± 431 (95% CI) calf muskoxen in the survey area. Approximately 11.4% of the muskoxen observed on transect were calves. The 1998 and 2001 estimates for non-calf muskox were not significantly different. However, there was a significant decline in the number of calves in the area. This suggests that population growth may have stabilized in this area.

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INTRODUCTION

The history of the decline of the Minto Inlet caribou (*Rangifer tarandus*) herd on northwest Victoria Island, NWT has been described by Gunn (2003) and Nishi and Buckland (2000). Gunn and Fournier (2000) defined the seasonal ranges of this herd. Recent nuclear DNA analysis of caribou tissues Zittlau *et al.* (in prep.) indicated that the Minto Inlet and Dolphin and Union herds on Victoria Island are distinct from each other and the Minto Inlet herd is most closely related to caribou on Banks Island. Minto Inlet and Banks Island caribou are considered to be Peary caribou (*Rangifer tarandus pearyi*).

Nishi and Buckland (2000) found few caribou in the area west of the Shaler Mountains and north of Minto Inlet during a survey conducted on northwest Victoria Island during early June 1994. Only four were seen on transect in the range of the Minto Inlet herd. These were observed west of Richard Collinson Inlet. A group of 6 to 10 caribou were observed along the coast between Richard Collinson Inlet and Glenelg Bay. Nagy (unpublished data) equipped 10 adult female caribou in this area with satellite collars during August 2003. Satellite location data obtained during 2003–2005 indicated that these caribou used the area south and east of Richard Collinson Inlet to the Shaler Mountains during the pre-calving to fall period. These caribou then migrated to and wintered on the mainland near Bathurst Inlet indicating that they were Dolphin and Union caribou (*Rangifer tarandus*) (Nagy, 2003–2005, unpublished data). The animals (Nishi and Buckland 2000) observed east of Richard

Collinson Inlet may have been some of the first Dolphin and Union caribou to expand there range onto northwest Victoria Island.

A survey conducted in 1998 by (Nagy *et al.*, 2007g) indicated that there were approximately 518 ± 210 non-calf caribou within the area north of Minto Inlet and west of the Shaler Mountains. Approximately 18% or 95 ± 60 (95% CI) of these caribou were found within the area used by satellite collared Minto Inlet Peary caribou during 1986–1988 (Gunn and Fournier, 2000) and were considered to be Minto Inlet Peary caribou. Approximately 82% or 423 ± 201 (95% CI) of the caribou were found in an area documented through satellite telemetry during 2003–2005 as the extreme northwestern portion of the pre-calving to fall ranges of the Dolphin & Union caribou herd (Nagy, unpublished data). These results indicate that the Minto Inlet herd had not disappeared and that some recovery of this herd had occurred between 1994 and 1998. The Dolphin & Union herd appeared to have recently expanded its range into the area immediately west of the Shaler Mountains north to the area between Richard Collinson Inlet and Glenelg Bay. This was an area where Nishi and Buckland (2000) found very few caribou in June 1994. There were 18,795 ± 2,869 (95% CI) non-calf muskoxen within the survey area. The highest numbers of muskoxen were observed in the area north of Minto Inlet between Walker Bay and the head of Minto Inlet. Only 5 wolves were observed during the survey but these were found within the range of the Minto Inlet herd.

The caribou and muskox populations on Banks Island have been surveyed every two to four years since 1982 (Latour, 1985; McLean *et al.*, 1986;

McLean, 1992; McLean and Fraser, 1992; Nagy *et al.*, 2007b; Nagy *et al.*, 2007c; Nagy *et al.*, 2007d; Nagy *et al.*, 2007e; Nagy *et al.*, 2007e; Nagy *et al.*, 2007d; Nagy *et al.*, 2007e; Nagy *et al.*, 2007f; McLean *et al.*, 1986; McLean, 1992; McLean and Fraser, 1992; Nagy *et al.*, 2007b; Nagy *et al.*, 2007c; Nagy *et al.*, 2007d). The draft National Recovery Plan for Peary caribou recommended that these Banks Island and Minto Inlet Peary caribou populations should be surveyed during the same years to account for potential movement of animals between the two areas. A systematic aerial strip census survey designed to obtain population estimates for and Peary caribou and muskox on Banks Island and northwest Victoria Island was conducted in July 1998 (Nagy *et al.*, 2007d; Nagy *et al.*, 2007g). In 2001 we conducted a similar survey on northwest Victoria Island with the following objectives:

- to obtain estimates of the number of non-calf and calf caribou and muskoxen,
- to determine the status of the Minto Inlet Peary caribou herd,
- to document observations of wolves and den sites,
- to document the distribution of caribou and muskoxen,
- to recommend whether the current quotas for caribou and muskoxen are sustainable, and
- if necessary, recommend management options to facilitate recovery of the Minto Inlet Peary caribou herd.

This report summarizes the results of survey complete on northwest Victoria Island during July 2001.

METHODS

In order to conduct a strip transect survey, we partitioned northwest Victoria Island into survey blocks of a size that transect lines, when oriented to intersect major river systems and drainages at approximately a 90° angle, could be flown in about 20 to 25 minutes (Figures 1 and 2). This was done to minimize observer fatigue. All survey blocks were flown at 20% coverage (transects spaced at 5-km intervals).

In preparation for the survey, we downloaded rasterized versions of the 1:250,000 NTS map sheets covering Northwest Victoria Island from Toporama http://toporama.cits.rncan.gc.ca/toporama_en.html. These were appended using PCI Geomatica software (Geomatica software Geomatica) to create a single raster covering the entire study area. We also created a transect line raster and added it to the 1:250,000 NTS raster using Geomatica software. The resulting digital map was imported into OziExplorer GPS software (OziExplorer GPS Mapping Software). Ozi Explorer is a computer software package that is designed to upload and download waypoint and track files from a GPS. We used OziExplorer to create waypoints at the start and end of each transect and gave each of these a unique identification number. These were stored in a digital database on a laptop computer.

Shape files were created for each survey block so that total area of each could be measured using ArcView 3.2 GIS software (Environmental Systems Research Institute). The specifications of the projection used are as follows: UTM Zone 11, NAD 83.

The survey crews were comprised of 1) a pilot, 2 observers seated in the back seat of the aircraft, and a recorder seated in the right front seat (Cessna 185) and 2) a pilot, 1 observer seated in the left back seat of the aircraft, and a observer/recorder seated in the right front seat (Helio Courier). Survey crews were equipped with a laptop computer with OziExplorer, a digital map of the survey area, and the digital transect waypoint database installed. Each day we used OziExplorer to download the waypoints of the transect end points from the laptop to the GPS of the aircraft. The pilot used these waypoints to navigated to the start and end points of each transect using the GPS of the aircraft. The aircraft flew at an altitude of 100 m above ground level and airspeed of 160 km/h.

Caribou were counted within and outside of the boundaries of a 500-m wide strip on each side of the aircraft. Muskoxen were counted within the strip. Strip width was marked using wooden dowels taped to the wing struts (Cessna 185) or tape marker on a wire stretched between the tie-down rings and the fuselage (Helio Courier) using the formula:

$$w = W \times h \div H$$

where w is the calculated strip width on the ground, W is the chosen survey strip width, h is the height of the observer on the ground, and H is the chosen survey altitude (Norton-Griffiths, 1987). All sightings of wolves were recorded.

The recorder had a Garmin 12XL GPS equipped with an external antenna mounted on the windscreen of the aircraft. The recorder created a waypoint for each caribou, muskox, and wolf observation and recorded the number of the waypoint and the number and types of caribou, muskoxen, and wolves observed

at each waypoint. At the end of each day the waypoint files were downloaded to the laptop computer. The files were then imported into Microsoft Excel and the waypoint coordinate data (number, latitude and longitude coordinates, date, and time) were appended to the observation data. We used the GPS to create a track file of all transects flown (location recorded every 30 seconds). The track files were downloaded to the laptop computer at the end of each flight.

Caribou were classified as adults (cows and yearlings), bulls, calves, or unknown. Muskoxen were classified as adults (age ≥ 1 year) and calves. Observers were equipped with binoculars to help ensure that counts and classifications were done accurately. If an observer had difficulty, the pilot flew the aircraft off transect and flew in a tight circle around the caribou or muskoxen, so that an accurate count and classification could be done. The pilot then flew the aircraft back to the transect and the survey resumed.

The waypoints and track files for all observations made along each transect line within each block were mapped using OziExplorer. All observations that were recorded before the starting point and after the end point of each transect were deleted. Only caribou that were observed off transect between transect lines within a survey block were included in the analyses. This was done to minimize the probability of including individuals/groups of caribou in the analyses more than once. The numbers of non-calf and calf caribou and muskoxen observed on and off transect for each transect were summarized using Microsoft Excel. The length of each transect was derived using the

waypoints for the start and end of each transect and the route function in OziExplorer.

The population estimates and associated statistics were calculated using the Aerial2 version 3.0 method 2 (Krebs, 1999). Estimates for non-calf, calf, and all caribou, and muskoxen, respectively, were derived for each survey block. Population and variance estimates from each stratum were combined to derive an overall population and population variance estimate for non-calf, calf, and all caribou and muskoxen, respectively, in all survey blocks.

The estimation of population number and variance from stratified surveys is given in Compton (1995) cited by Johnson *et al.* (2004). The total population number is the summation of individual strata estimates (equation 1):

$$\hat{N}_{total} = \sum_{h=1}^{L} \hat{N}_h$$

where there are L strata units. Assuming that the selection of sample units within each stratum is independent of other strata units, the variance is estimated as the sum of individual variance estimates for each stratum (equation 2):

$$\mathrm{var}_{total} = \sum_{h=1}^{L} \mathrm{var}_h$$

Confidence intervals for the population estimate can be approximated by (equation 3):

$$\hat{N}_{total} \pm t\sqrt{\mathrm{var}_{total}}$$

The degrees of freedom (d) for the t-statistic can be approximated by the following formula (equation 4):

$$d = \frac{\left(\sum_{h=1}^{L} a_h s_h^2\right)^2}{\left[\sum_{h=1}^{L}\left(\left(a_h s_h^2\right)^2 / (n_h - 1)\right)\right]}$$

where $a_h = N_h(N_h - n_h)/n_h$ where N_h is the possible number of transects in an individual block and n_h is the actual number of transects flown. The sample variance from each block is denoted as s^2 in the above formula, and L is the total number of strata (Compton *et al.*, 1995) cited by Johnson *et al.* (2004). This assumes that the population estimates and variance estimates from each stratum are unbiased and independent.

We used a two-tailed t-test to determine whether the estimates of the non-calf caribou and muskoxen in 2001 were significantly different from those in 1998. We calculated the t-statistic (t^2) using the following formula (from Section 4.2.1.2, page 62, Gasaway *et al.*, 1986) (equation 5):

$$t^2 = T_{2001} - T_{1998} / [V(T_{2001} + V(T_{1998})]^{0.5}$$

where:

- T_{2001} and T_{1998} = population estimates of non-calf and calf caribou and muskox from surveys in 2001 and 1998, respectively
- $V(T_{2001})$ and $V(T_{1998})$ = variances of population estimates of non-calf and calf caribou and muskoxen from surveys in 2001 and 1998, respectively

We used the following formula to estimate the total degrees of freedom (v_t) associated with the t-statistic (from Section 4.2.1.2, page 62, Gasaway *et al.*, 1986) (equation 6):

$$[V(T_{2001})+V(T_{1998})]^2/\{[V(T_{2001})^2/v_{o2001}]+[V(T_{1998})^2/v_{o1998}]\}$$

where:

- $V(T_{2001})$ and $V(T_{1998})$ = variances of population estimates of non-calf and calf caribou and muskox from surveys in 2001 and 1998, respectively
- v_{o2001} and v_{o1998} = degrees of freedom from surveys in 2001 and 1998, respectively (derived from equation 4).

We mapped the distribution of locations obtained for satellite-collared Minto Inlet Peary caribou (Gunn and Fournier, 2000) and Dolphin & Union caribou (J. Nishi, unpublished data; J. Nagy, unpublished data) in relationship to the boundaries of the survey blocks. This was done to determine the relative probability that caribou observed in a survey block belonged to the Minto Inlet or Dolphin & Union herd.

Maps showing the distribution of caribou observed on and off transect, muskoxen observed on transect, and wolves on northwest Victoria Islands were created using ArcView (Environmental Systems Research Institute).

RESULTS

The survey was completed between 16 to 21 July 2001 on northwest Victoria Islands. Weather conditions we nearly ideal and we were able to complete the survey in a relatively short time period. All transect lines were flown as planned (Figure 2).

Peary caribou

The distribution of non-calf and calf caribou observed during the survey is shown in Figures 3 and 4, respectively. We observed a total of 254 non-calf and 71 calf caribou on transect giving estimates of 1,271 ± 384 (95% CI) non-calf and 355 ± 152 (95% CI) calf caribou on the island (Table 1). The 2001 estimate of non-calf caribou was significantly greater than that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 3.463, DF = 80, P<0.001). Similarly, the estimate of calf caribou was significantly greater than that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 2.638, DF = 81, P<0.001). We observed a total of 424 non-calf and 112 calf caribou on and off transect giving a ratio of 26.4 calves per 100 non-calf caribou. Approximately 20.9% of the caribou observed were calves. The majority of these caribou (372 non-calf) and (96 calves) were found in survey block C (Table 1 and Figures 3 and 4).

Figures 5 and 6 show the distribution of satellite-collared Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey blocks. These data suggest that caribou observed in survey blocks A and B were of the Minto Inlet Peary caribou herd, while those in survey block C were of the Dolphin & Union herd.

The total number of caribou observed on transect in survey blocks A and B was 41 non-calf and 13 calf caribou giving estimates of 204 ± 103 (95% CI) non-calf and 65 ± 59 (95% CI) calf caribou for the Minto Inlet herd (Table 2 and Figure 7). The total number of caribou observed on and off transect was 52 non-calf and 16 calf caribou. There were 30.8 calves per 100 non-calf caribou.

Approximately 23.5% of the caribou observed were calves. The 2001 estimate of non-calf caribou was not significantly different from that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 1.902, DF = 34, P>0.05). Similarly the estimate of calf caribou was not significantly different from that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 1.698, DF = 24, P>0.05). A comparison of the mean population estimates for 1998 and 2001 suggests that the population grew at an average annual finite rate of 38% per year (Caughley, 1980). These data suggest that the Minto Inlet herd may have gone through a period of recovery during 1998 to 2001.

The total number of caribou observed on transect in survey block C was 213 non-calf and 58 calf caribou giving estimates of 1,067 ± 371 (95% CI) non-calf and 291 ± 141 (95% CI) calf caribou for Dolphin & Union caribou in the area (Table 2 and Figure 8). The total number of caribou observed on and off transect was 372 non-calf and 96 calf caribou. There were 25.8 calves per 100 non-calf caribou. Approximately 20.5% of these were calves. The 2001 estimate of non-calf caribou was significantly greater than that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 3.069, DF = 80, P<0.001). Similarly the estimate of calf caribou was significantly greater than that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 2.194, DF = 84, P<0.05). A comparison of the mean population estimates for 1998 and 2001 suggests that the population grew at a average annual finite rate of 51% per year (Caughley, 1980). These data suggest that the number of Dolphin & Union caribou in the area also increased during 1998 to 2001.

We found no evidence of caribou mortalities.

Muskox

The distribution of non-calf and calf muskoxen observed during the survey is shown in Figures 9 and 10, respectively. We observed a total of 3,850 non-calf and 494 calf muskoxen on transect giving estimates of 19,282 ± 3,221 (95% CI) non-calf and 2,474 ± 431 (95% CI) calf muskoxen on the island (Table 3 and Figure 11). There were 12.8 calves per 100 non-calf muskoxen. Approximately 11.4% of the muskoxen observed were calves. The 2001 estimate of non-calf muskoxen was not significantly different from that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 0.229, DF = 76, P>0.05). However, the estimate of calf muskoxen was significantly lower that reported for 1998 (Nagy *et al.*, 2007d) (t^2 = 4.141, DF = 49, P<0.001). A comparison of mean population estimates for 1998 (Nagy *et al.*, 2007d) and 2001 indicates that the non-calf muskox population increased at an annual finite rate of 1% per year during this period (Caughley, 1980) (Figure 11).

We found no evidence of caribou mortalities.

Wolves

We observed a total of 11 wolves. These were found within the range of the Minto Inlet Peary caribou herd (Figure 12).

DISCUSSION

The results of our survey indicate that there were approximately 1,271 ± 384 (95% CI) non-calf caribou within the 36,021 km^2 area surveyed north of

Minto Inlet and west of the Shaler Mountains. Approximately 16% of 204 ± 103 (95% CI) of these caribou were found within the area used by satellite-collared Minto Inlet caribou between 1986 and 1988 (Gunn and Fournier, 2000) and were considered to be Minto Inlet Peary caribou. Approximately 84% or 1,067 ± 371 (95% CI) of the caribou were found within an area documented by through satellite telemetry between 2003 and 2005 as Dolphin & Union caribou pre-calving to fall ranges (Nagy, unpublished data).

The results of this survey further indicate that the Minto Inlet herd has continued to persist in low numbers in the area. Although a statistical comparison indicated that the population estimates for 1998 and 2001 were not significantly different, a comparison of the mean population estimates suggests that further recovery of this herd occurred between 1998 and 2001. The number of Dolphin & Union caribou in the area between Richard Collinson Inlet and Glenelg Bay continued to increase, with significantly more of these caribou in the area in 2001 than in 1998. Very few caribou were observed in this area in June 1994 (Nishi and Buckland, 2000).

There were 19,282 ± 3,221 non-calf muskoxen within the survey area. There was no significant change in the numbers of non-calf muskoxen between 1998 and 2001 in the area. In comparison there was a significant decline in the number of calves. We do not know whether this was a result of lower pregnancy rates or higher post-calving mortality rates. These data suggest that the muskox population in this area has stabilized.

We observed 11 wolves during the survey. As in 1998, all were found within the range of the Minto Inlet herd.

There continues to be a large number of muskox in the area. As in 1998, most of the of muskoxen observed were in the area north of Minto Inlet between Walker Bay and the head of Minto Inlet.

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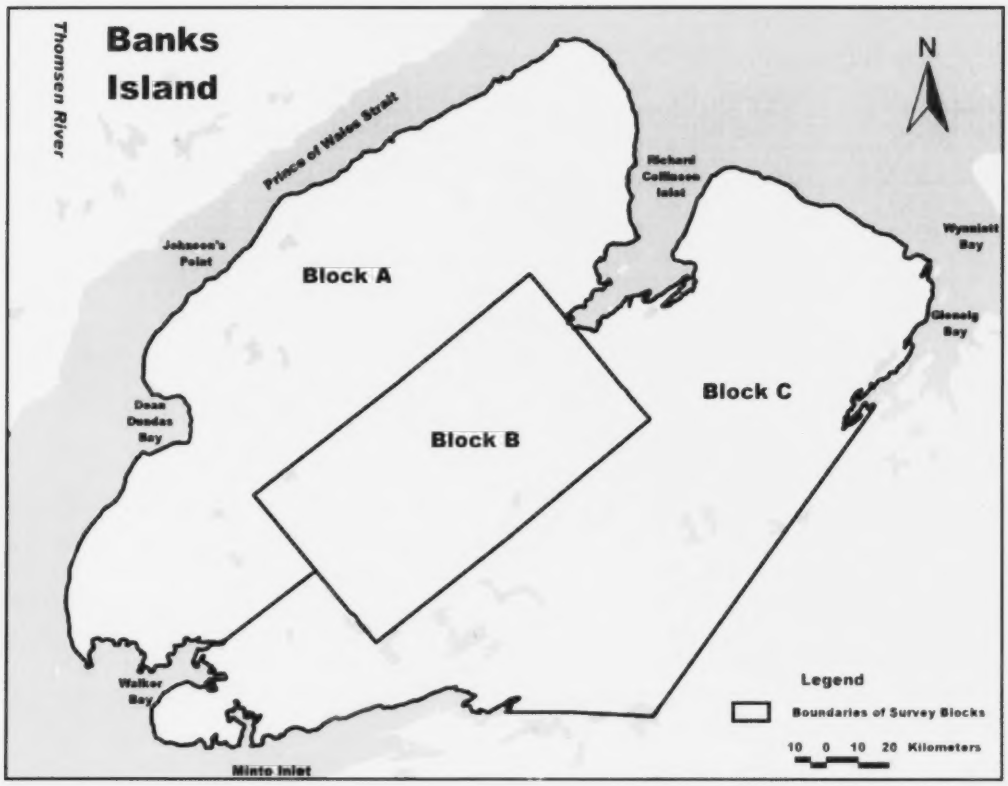

Figure 1. Location of survey blocks for the July 2001 northwest Victoria Island Peary caribou and muskoxen survey.

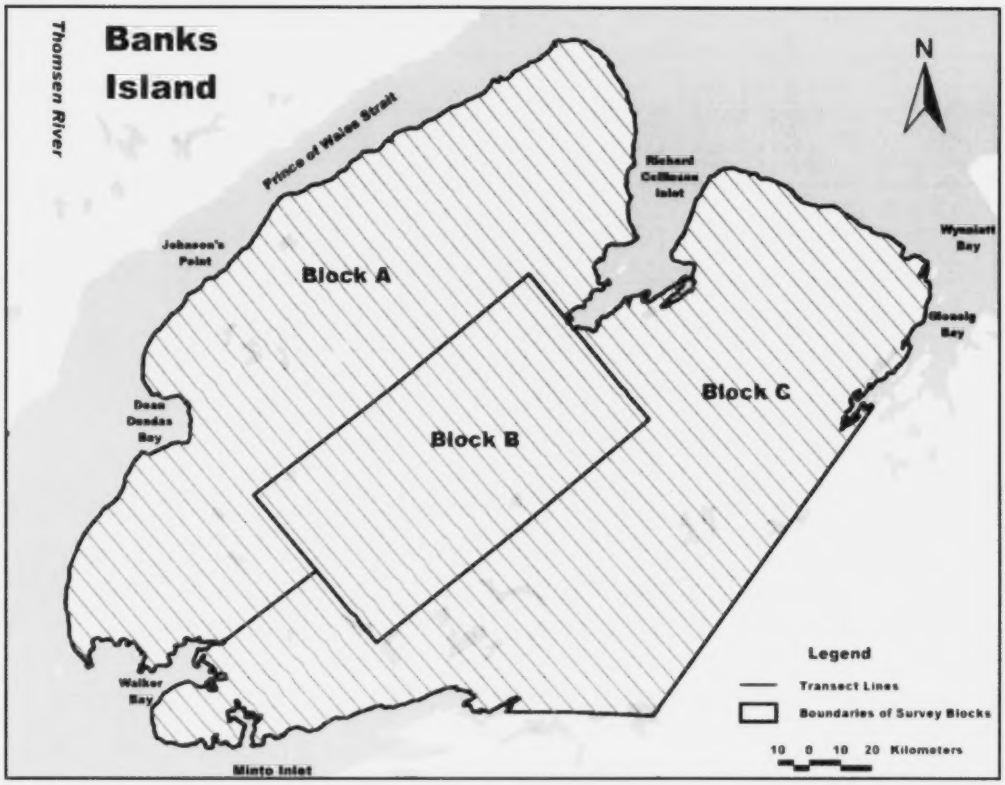

Figure 2. Distribution of survey blocks and transect lines for the July 2001 northwest Victoria Island survey as planned and flown.

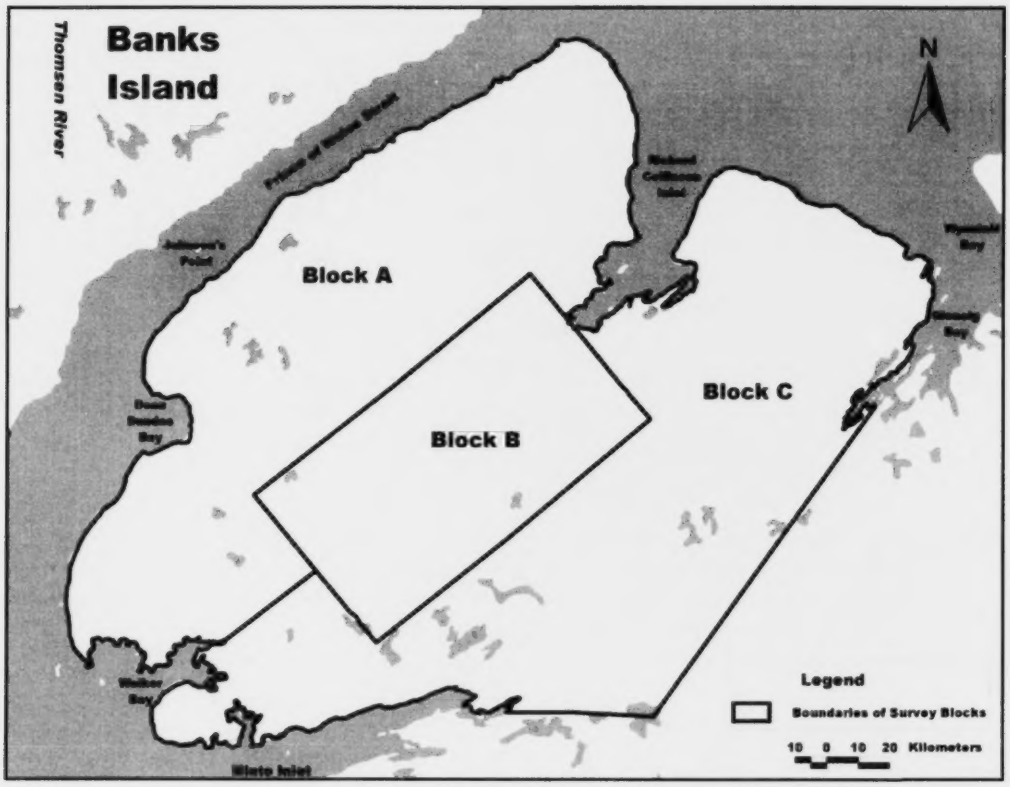

Figure 1. Location of survey blocks for the July 2001 northwest Victoria Island Peary caribou and muskoxen survey.

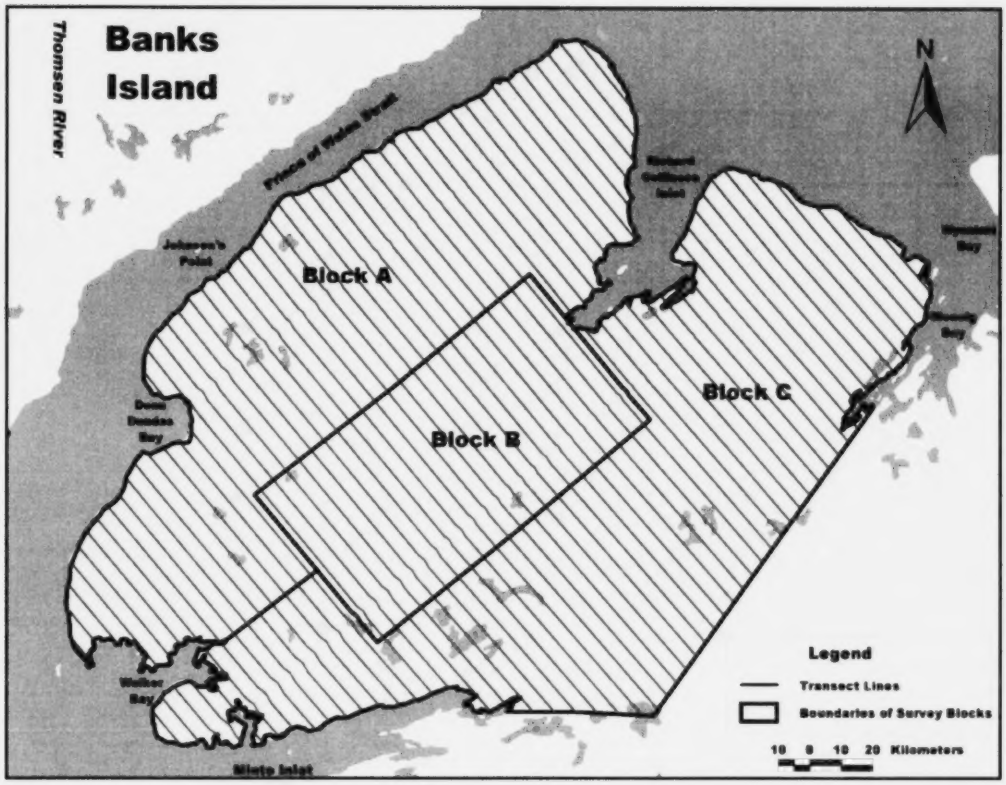

Figure 2. Distribution of survey blocks and transect lines for the July 2001 northwest Victoria Island survey as planned and flown.

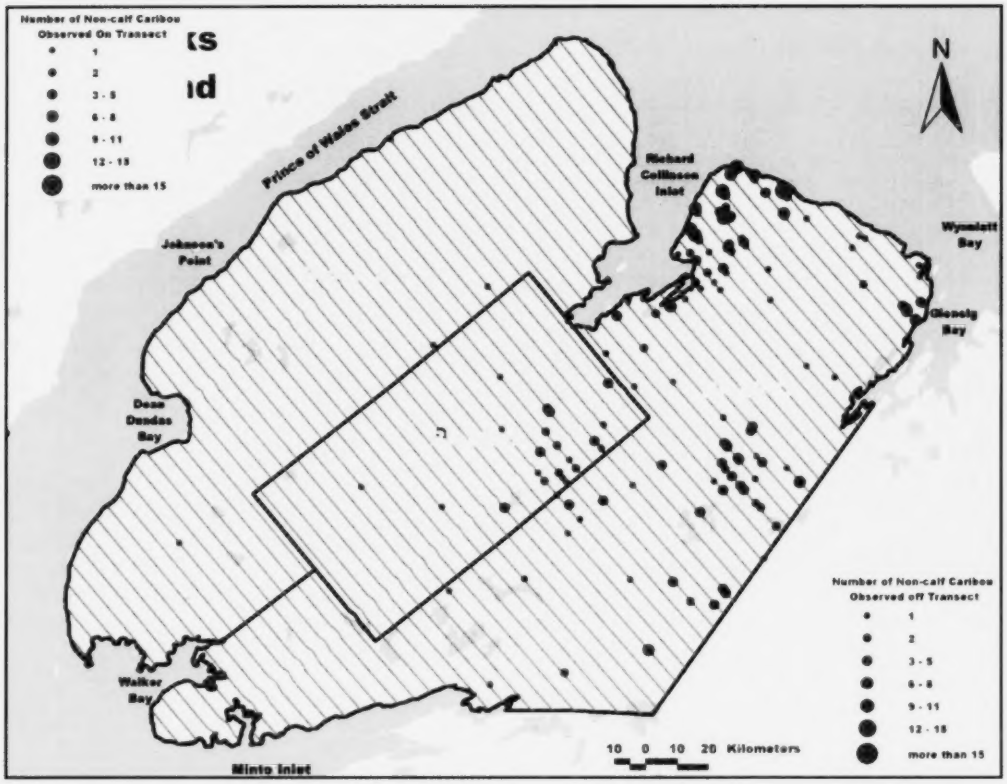

Figure 3. Distribution of non-calf caribou on northwest Victoria Island during July 2001.

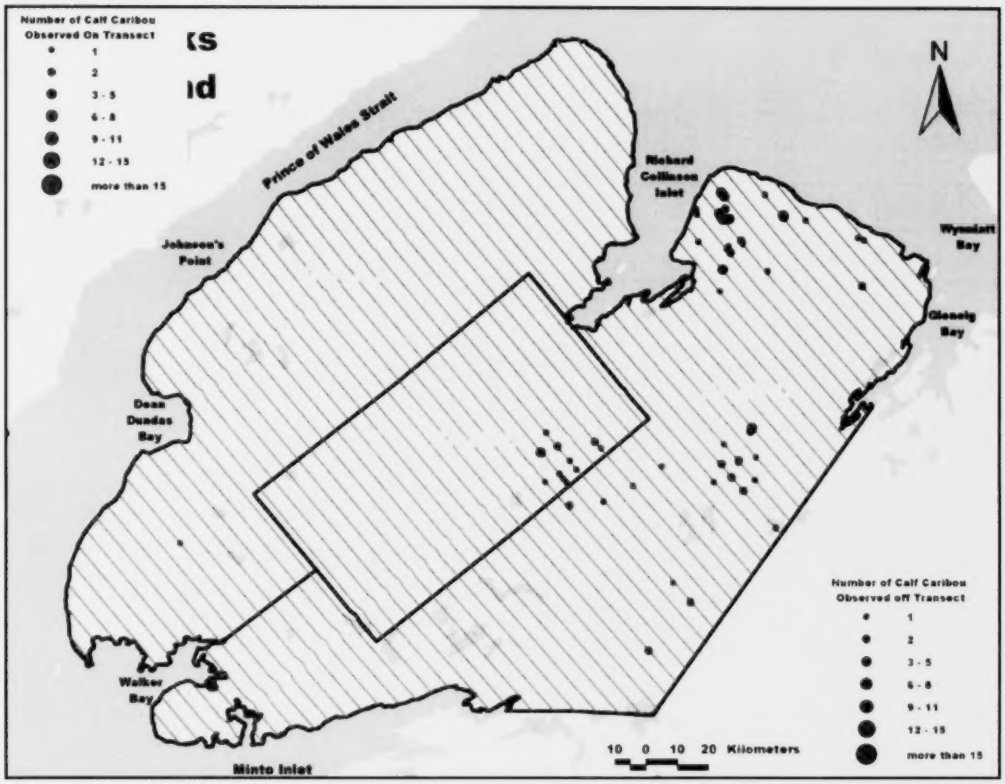

Figure 4. Distribution of calf caribou on northwest Victoria Island during July 2001.

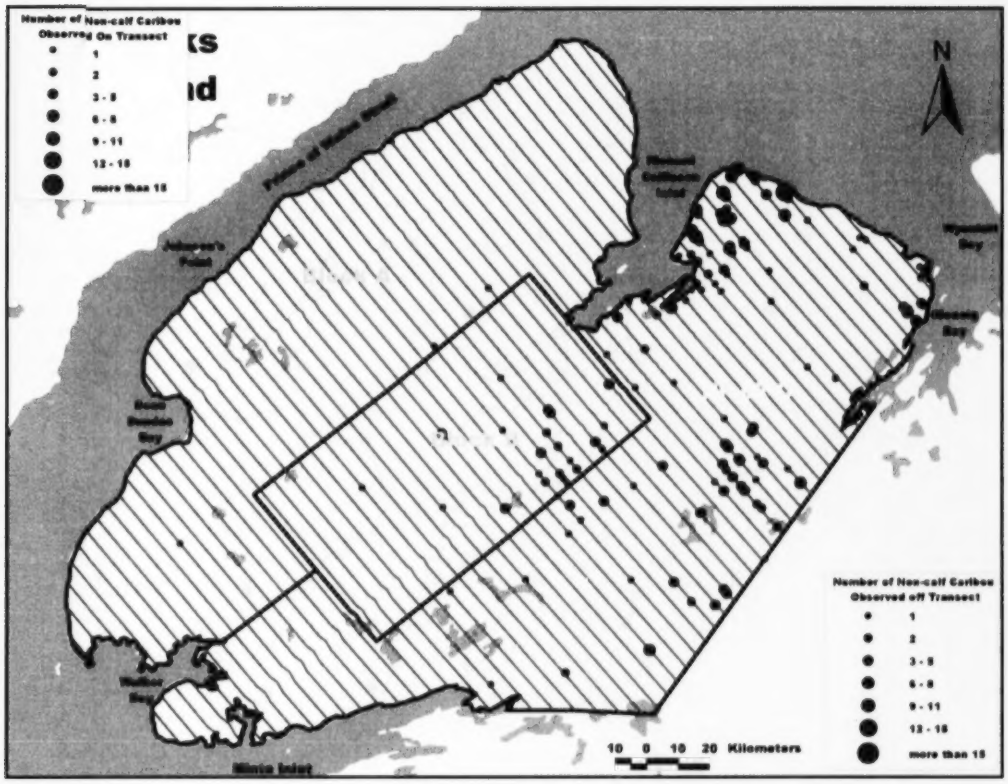

Figure 3. Distribution of non-calf caribou on northwest Victoria Island during July 2001.

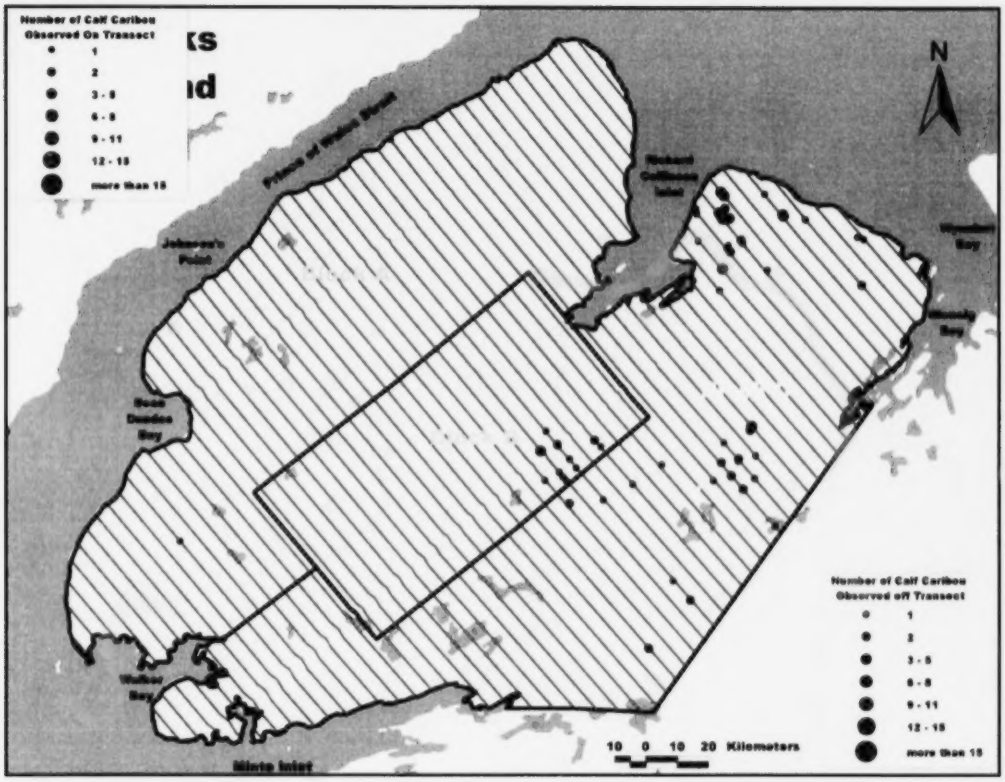

Figure 4. Distribution of calf caribou on northwest Victoria Island during July 2001.

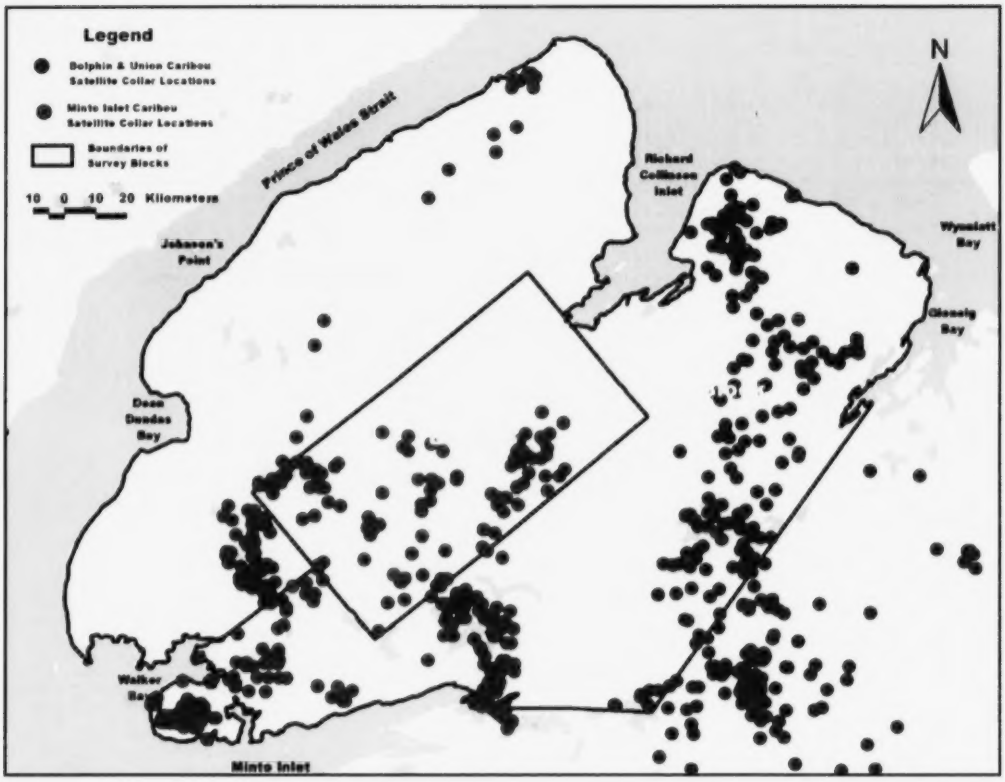

Figure 5. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

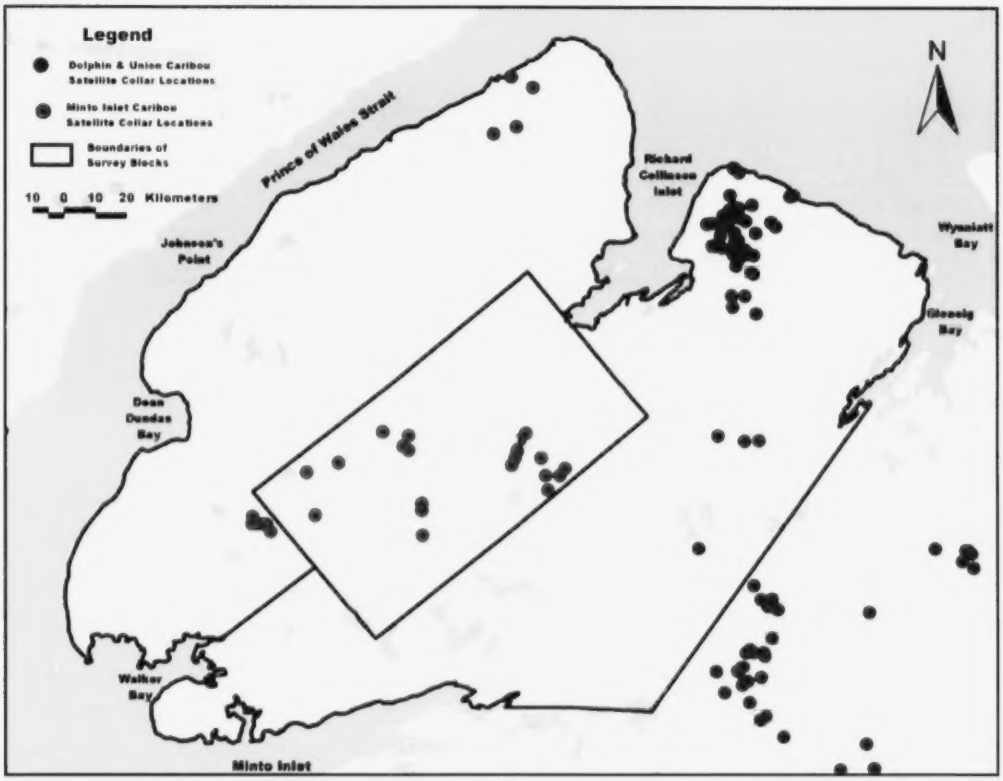

Figure 6. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou during 15 July to 15 August in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

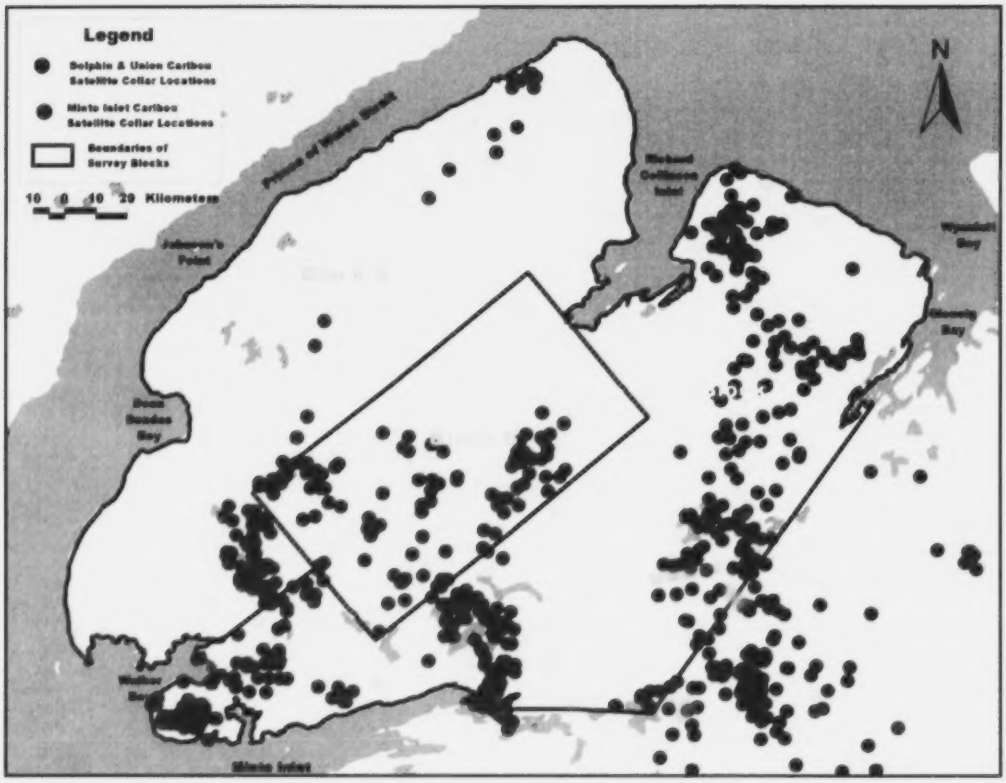

Figure 5. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

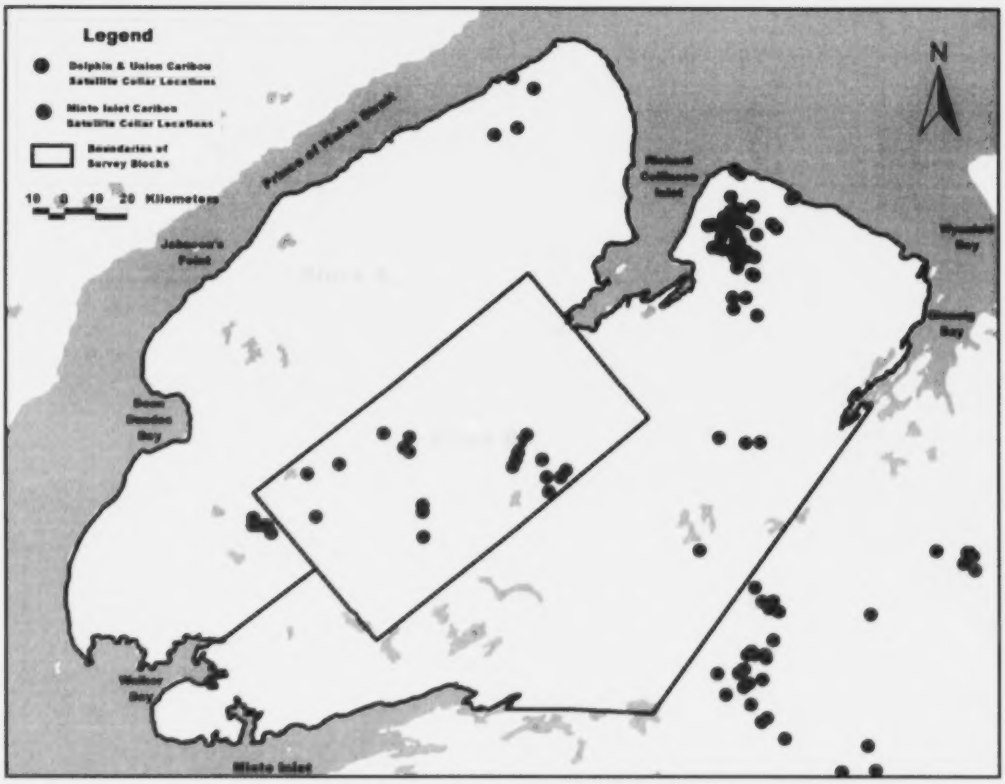

Figure 6. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou during 15 July to 15 August in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

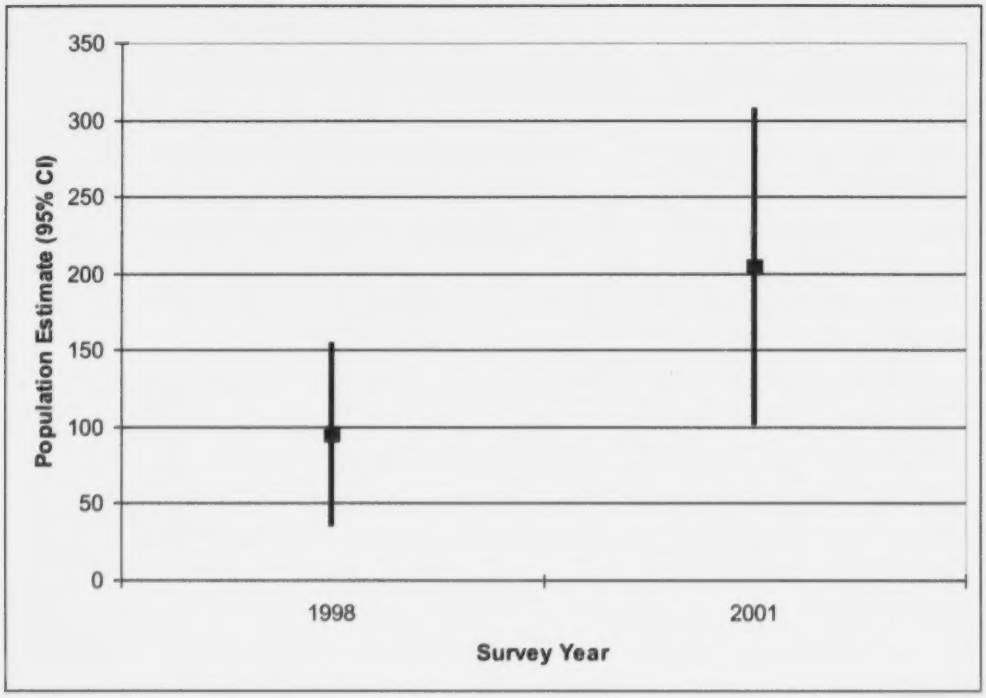

Figure 7. Population estimates with 95% CI for non-calf Minto Inlet Peary caribou on northwest Victoria Island, NT, 1998 to 2001[A].

[A] Population estimates obtained from:
- 1998 (Nagy *et al.*, 2007g)
- 2001 (this study)

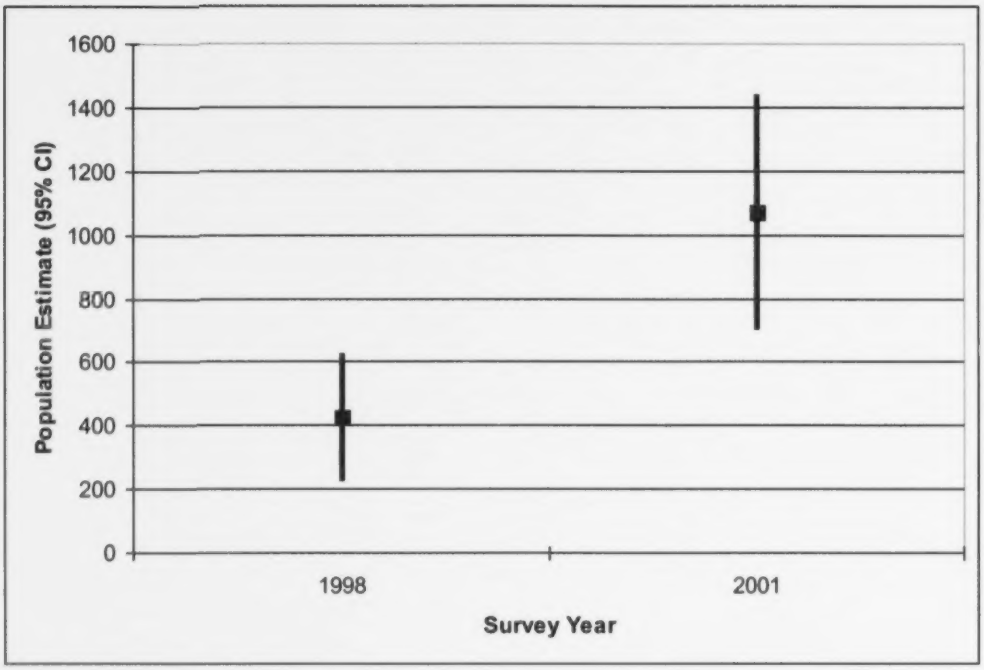

Figure 8. Population estimates with 95% CI for non-calf Dolphin & Union caribou on northwest Victoria Island, NT, 1998 to 2001[A].

[A] Population estimates obtained from:
- 1998 (Nagy *et al.*, 2007g)
- 2001 (this study)

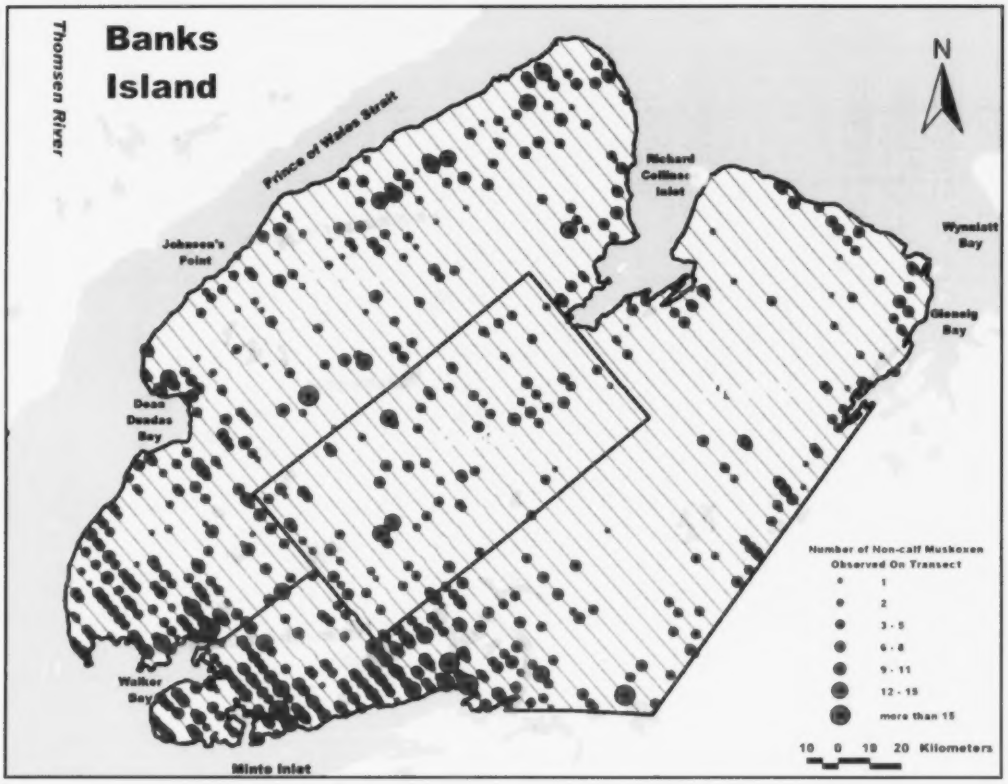

Figure 9. Distribution of non-calf muskoxen on northwest Victoria Island July 2001.

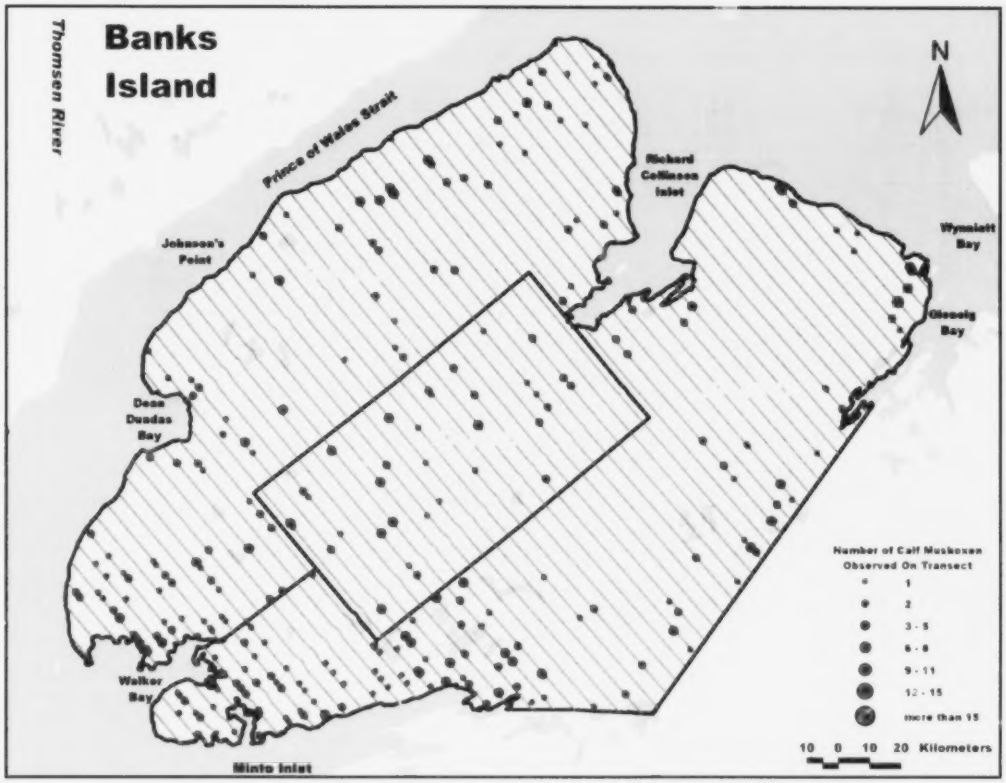

Figure 10. Distribution of calf muskoxen on northwest Victoria Island during July 2001.

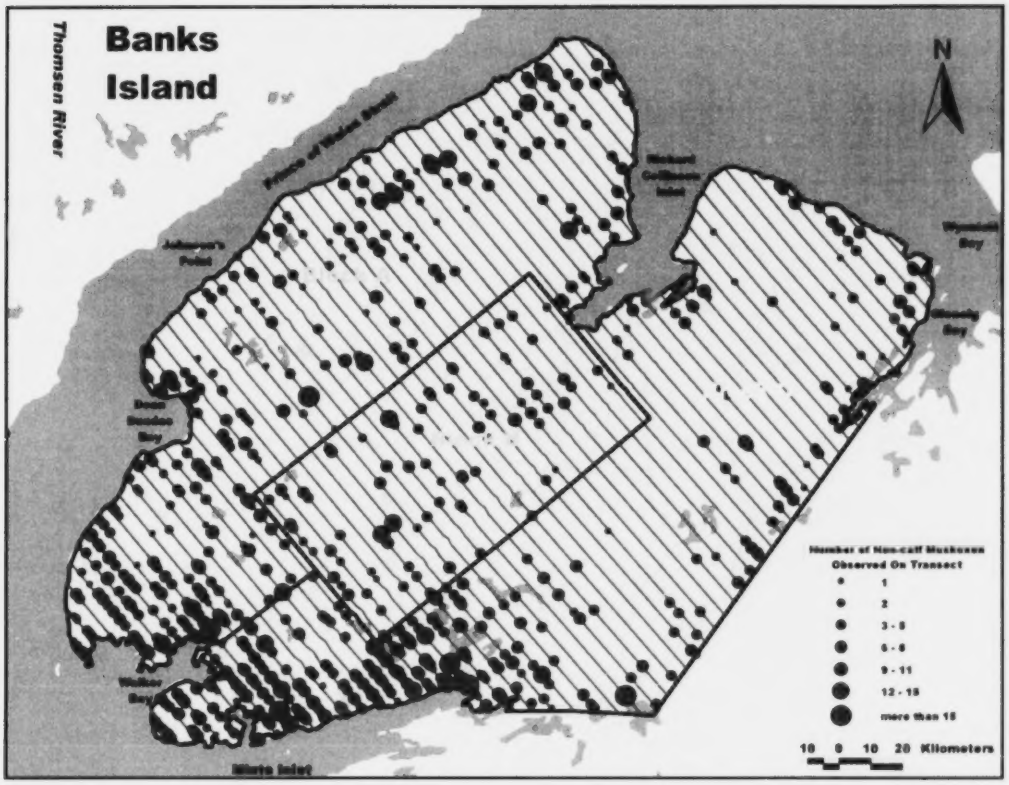

Figure 9. Distribution of non-calf muskoxen on northwest Victoria Island July 2001.

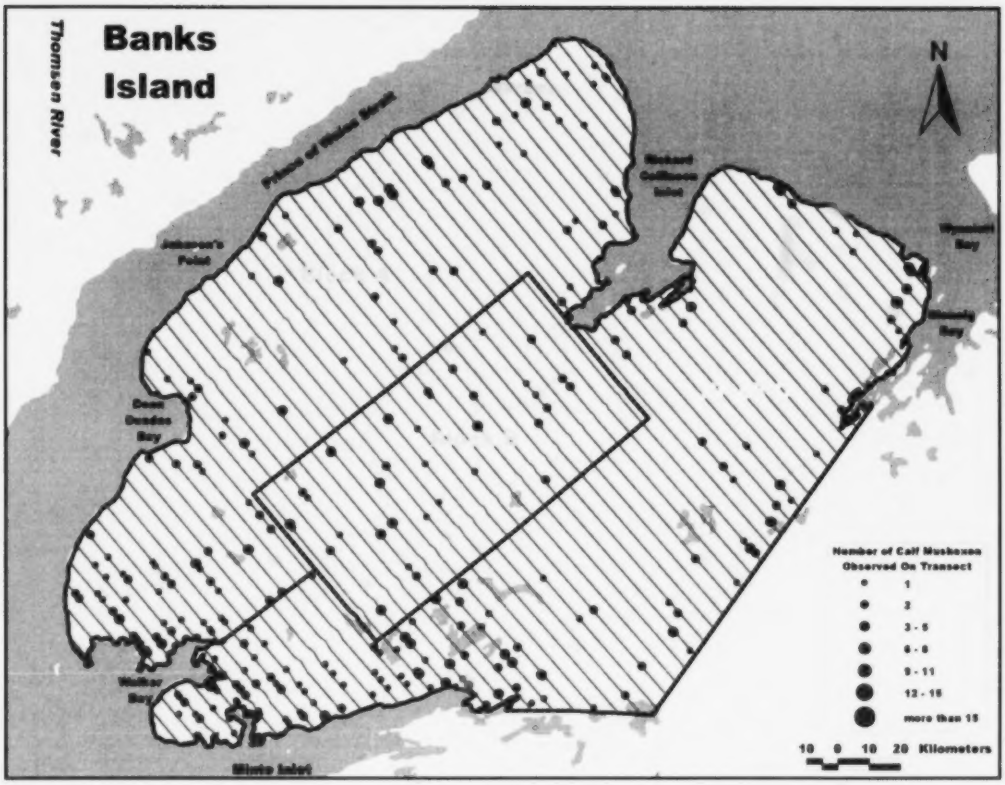

Figure 10. Distribution of calf muskoxen on northwest Victoria Island during July 2001.

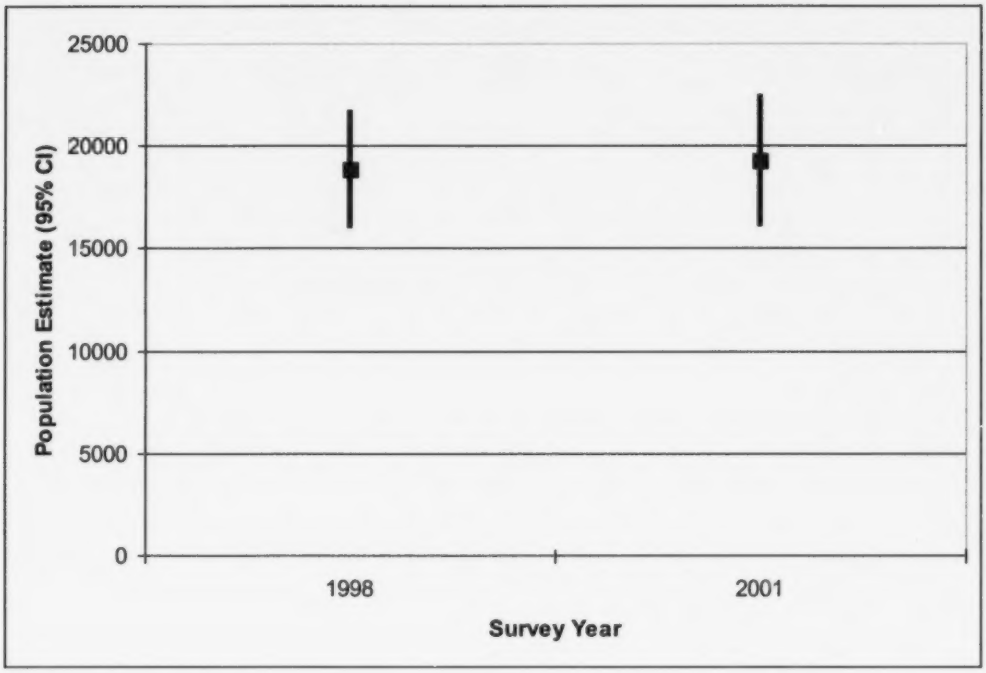

Figure 11. Population estimates with 95% CI for non-calf muskox on northwest Victoria Island, NT, 1998 to 2001[A].

[A] Population estimates obtained from:
- 1998 (Nagy et al., 2007g)
- 2001 (this study)

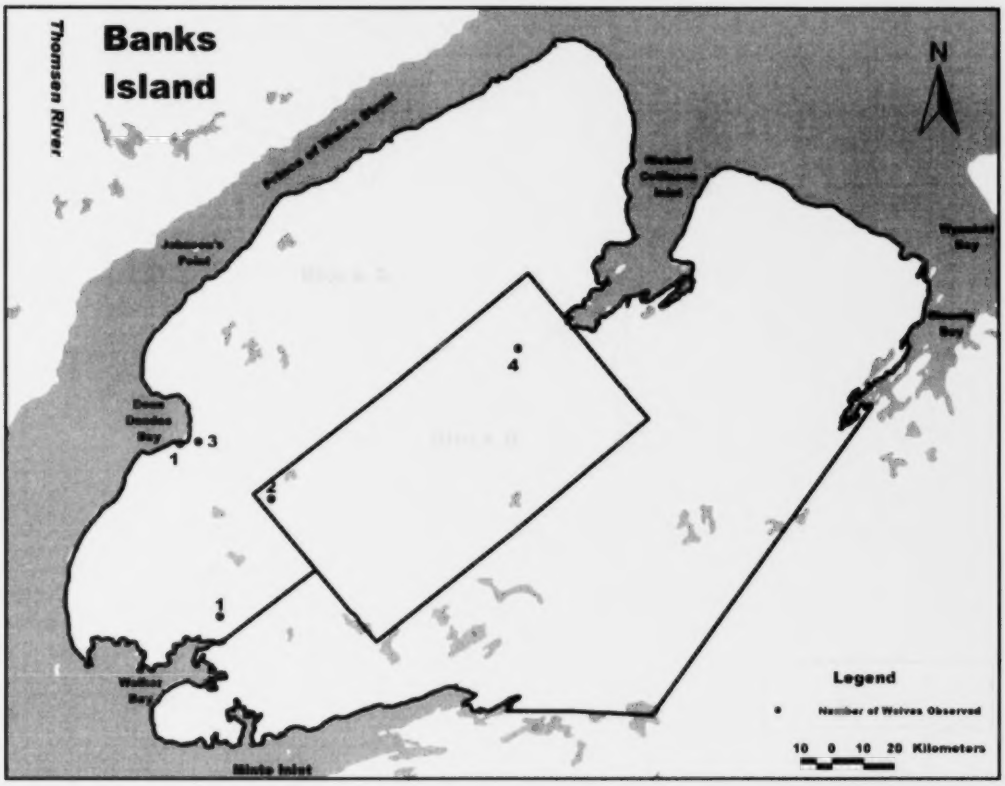

Figure 12. Distribution of wolves observed during the 2001 northwest Victoria Island caribou and muskox survey.

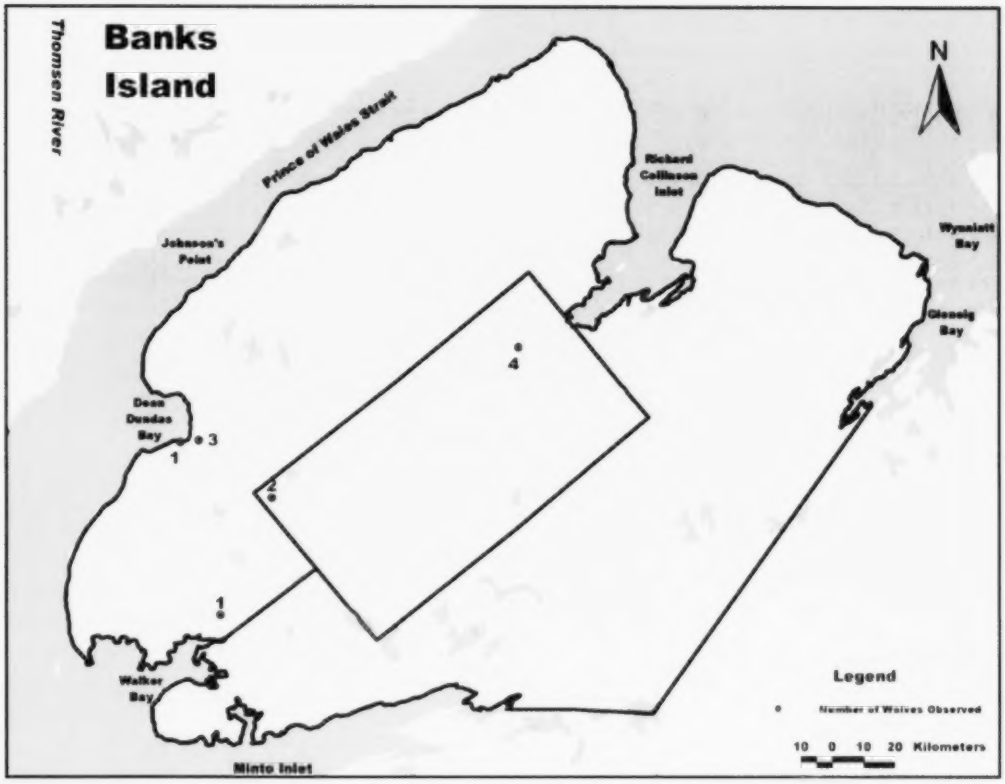

Figure 12. Distribution of wolves observed during the 2001 northwest Victoria Island caribou and muskox survey.

Table 1. Population estimates for caribou on northwest Victoria Island, July 2001.

Stratum	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Caribou: Non-calf													
A	13,799	49	245.7	0.001	10	39.3	6.3	13	19.9	2	0	0.625	
B	6,565	22	109.9	0.030	194	2434.8	49.3	28	20.1	39	11	0.254	
C	15,657	56	279.2	0.068	1067	34249.7	185.1	370	20.0	213	159	0.173	
sum of blocks	36,021	127	634.8	0.035	1271	36723.9	191.6	384	20.0	254	170	0.151	55
Caribou: Calf													
A	13,799	49	245.7	0.000	5	20.1	4.5	9	19.9	1	0	0.895	
B	6,565	22	109.9	0.009	60	784.5	28.0	58	20.1	12	3	0.469	
C	15,657	56	279.2	0.019	291	4943.3	70.3	141	20.0	58	38	0.242	
sum of blocks	36,021	127	634.8	0.010	355	5747.9	75.8	152	20.0	71	41	0.213	55
Caribou: Total													
A	13,799	49	245.7	0.001	15	98.7	9.9	20	19.9	3	0	0.661	
B	6,565	22	109.9	0.039	254	4805.0	69.3	144	20.1	51	14	0.273	
C	15,657	56	279.2	0.087	1357	57550.9	239.9	480	20.0	271	197	0.177	
sum of blocks	36,021	127	634.8	0.045	1626	62454.6	249.9	501	20.0	325	211	0.154	55

Table 2. Population estimates for Peary caribou (Minto Inlet herd) and Dolphin & Union caribou on northwest Victoria Island, July 2001.

Stratum	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Minto Inlet Peary Caribou													
Caribou: adults													
A	13,799	49	245.7	0.001	10	39.3	6.3	13	19.94	2	0	0.625	
B	6,565	22	109.9	0.030	194	2434.8	49.3	28	20.08	39	11	0.254	
sum of blocks	20,364	71	355.6	0.010	204	2474.1	49.7	103	35.34	41	11	0.244	21
Caribou: calves													
A	13,799	49	245.7	0.000	5	20.1	4.5	9	19.94	1	0	0.895	
B	6,565	22	109.9	0.009	60	784.5	28.0	58	20.08	12	3	0.469	
sum of blocks	20,364	71	355.6	0.003	65	804.6	28.4	59	35.34	13	3	0.438	21
Caribou: total													
A	13,799	49	245.7	0.001	15	98.7	9.9	20	19.94	3	0	0.661	
B	6,565	22	109.9	0.039	254	4805.0	69.3	144	20.08	51	14	0.273	
sum of blocks	20,364	71	355.6	0.013	269	4903.8	70.0	146	35.34	54	14	0.260	21
Dophin & Union Caribou													
Caribou: adults													
C	15,657	56	279.2	0.068	1067	34249.7	185.1	370	19.96	213	159	0.173	55
Caribou: calves													
C	15,657	56	279.2	0.019	291	4943.3	70.3	141	19.96	58	38	0.242	55
Caribou: total													
C	15,657	56	279.2	0.087	1357	57550.9	239.9	480	19.96	271	197	0.177	55

Table 3. Population estimates for muskox on northwest Victoria Island, July 2001.

Stratum	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Muskox: Non-calf													
A	13,799	49	245.7	0.570	7862	616513.7	785.2	1579	19.9	1568	not recorded	0.100	
B	6,565	22	109.9	0.288	1892	41326.3	203.3	423	20.1	380	not recorded	0.107	
C	15,657	56	279.2	0.609	9527	1923067.5	1386.7	2773	20.0	1902	not recorded	0.146	
sum of blocks	36,021	127	634.8	0.535	19282	2580907.5	1606.5	3221	20.0	3850		0.083	54
Muskox: Calf													
A	13,799	49	245.7	0.069	948	14319.1	119.7	241	19.9	189	not recorded	0.126	
B	6,565	22	109.9	0.051	334	2433.4	49.3	103	20.1	67	not recorded	0.148	
C	15,657	56	279.2	0.076	1192	29383.0	171.4	343	20.0	238	not recorded	0.144	
sum of blocks	36,021	127	634.8	0.069	2474	46135.6	214.8	431	20.0	494		0.087	54
Muskox: Total													
A	13,799	49	245.7	0.638	8810	771040.3	878.1	1766	19.9	1757	not recorded	0.100	
B	6,565	22	109.9	0.339	2226	58870.6	242.6	505	20.1	447	not recorded	0.109	
C	15,657	56	279.2	0.685	10719	2339697.2	1529.6	3059	20.0	2140	not recorded	0.143	
sum of blocks	36,021	127	634.8	0.604	21755	3169608.2	1780.3	3569	20.0	4344		0.082	54

APPENDIX A.

Transect data for the 2001 northwest Victoria Island caribou and muskoxen survey.

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
A	A01	9.674	0	0	0	9	0	9
	A02	12.728	0	0	0	19	0	19
	A03	25.221	0	0	0	17	4	21
	A05	41.746	0	0	0	89	18	107
	A06	44.408	0	0	0	69	10	79
	A07	46.309	0	0	0	66	9	75
	A08	49.310	0	0	0	69	3	72
	A09	55.087	0	0	0	102	9	111
	A10	56.313	0	0	0	40	2	42
	A11	59.476	1	1	2	54	8	62
	A12	61.646	0	0	0	17	2	19
	A13	61.395	0	0	0	36	4	40
	A14	59.764	0	0	0	37	5	42
	A15	57.949	0	0	0	31	3	34
	A17	68.868	0	0	0	78	5	83
	A18	56.774	0	0	0	78	6	84
	A19	58.851	0	0	0	41	8	49
	A20	59.452	0	0	0	16	0	16
	A21	59.878	0	0	0	0	0	0
	A22	61.420	0	0	0	18	4	22
	A23	61.090	0	0	0	10	0	10
	A24	60.814	0	0	0	36	0	36
	A25	60.531	0	0	0	13	0	13
	A26	61.672	0	0	0	15	1	16
	A27	61.716	0	0	0	27	4	31
	A28	63.312	0	0	0	28	2	30
	A29	65.067	0	0	0	9	0	9
	A30	66.697	0	0	0	21	4	25
	A31	66.366	0	0	0	20	3	23
	A32	64.322	0	0	0	12	2	14
	A33	62.668	0	0	0	27	4	31
	A34	61.528	0	0	0	19	3	22
	A35	61.779	0	0	0	39	6	45
	A36	61.930	0	0	0	33	12	45
	A37	59.821	1	0	1	15	0	15

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	A38	59.047	0	0	0	1	0	1
	A39	59.688	0	0	0	32	7	39
	A40	74.421	0	0	0	53	5	58
	A41	74.507	0	0	0	16	3	19
	A42	72.488	0	0	0	17	0	17
	A43	66.301	0	0	0	22	3	25
	A45	62.741	0	0	0	22	4	26
	A46	63.736	0	0	0	19	3	22
	A47	64.295	0	0	0	29	5	34
	A48	54.146	0	0	0	38	8	46
	A49	46.271	0	0	0	53	3	56
	A50	43.593	0	0	0	11	1	12
	A51	38.643	0	0	0	8	1	9
	A52	26.543	0	0	0	37	5	42
	Total	2752.002	2	1	3	1568	189	1757
B	B01	60.134	0	0	0	37	5	42
	B02	60.151	0	0	0	25	5	30
	B03	60.169	0	0	0	18	4	22
	B04	60.187	0	0	0	3	0	3
	B05	60.204	0	0	0	38	6	44
	B06	60.222	1	0	1	24	7	31
	B07	60.239	0	0	0	17	4	21
	B08	60.256	0	0	0	12	3	15
	B09	60.273	1	0	1	14	1	15
	B10	60.290	0	0	0	31	4	35
	B11	60.308	0	0	0	17	1	18
	B12	60.235	7	0	7	10	1	11
	B13	60.113	0	0	0	9	3	12
	B14	59.991	0	0	0	20	4	24
	B15	59.869	4	1	5	23	6	29
	B16	59.747	5	5	10	11	0	11
	B17	59.624	5	3	8	14	2	16
	B18	59.502	5	0	5	20	5	25
	B19	59.380	5	3	8	13	0	13
	B20	59.258	1	0	1	17	6	23
	B21	59.136	1	0	1	0	0	0
	B22	58.956	4	0	4	7	0	7
	Total	1318.244	39	12	51	380	67	447

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
C	C01	13.579	0	0	0	32	0	32
	C02	17.955	0	0	0	58	3	61
	C04	22.789	0	0	0	58	7	65
	C05	24.458	0	0	0	29	2	31
	C10	16.240	0	0	0	6	3	9
	C13	35.615	0	0	0	72	8	80
	C14	34.501	0	0	0	121	5	126
	C15	39.350	0	0	0	111	13	124
	C16	39.938	0	0	0	122	15	137
	C17	42.475	0	0	0	32	2	34
	C18	43.780	0	0	0	62	3	65
	C19	45.550	0	0	0	63	3	66
	C20	49.378	0	0	0	58	4	62
	C21	51.420	0	0	0	91	6	97
	C22	23.315	0	0	0	49	8	57
	C23	25.074	0	0	0	110	15	125
	C24	39.085	0	0	0	91	9	100
	C28	41.013	1	0	1	68	6	74
	C29	47.432	0	0	0	59	11	70
	C31	51.702	1	0	1	55	11	66
	C32	55.914	0	0	0	49	11	60
	C33	60.535	2	0	2	32	1	33
	C34	65.165	0	0	0	9	0	9
	C35	69.807	0	0	0	24	2	26
	C36	71.452	0	0	0	35	2	37
	C37	70.140	0	0	0	12	4	16
	C38	68.846	6	2	8	13	0	13
	C39	67.552	1	0	1	0	0	0
	C40	66.257	4	2	6	13	4	17
	C41	64.963	0	0	0	16	3	19
	C42	63.669	5	3	8	3	0	3
	C43	62.374	0		0	0	0	0
	C44	61.078	1	1	2	4	2	6
	C45	59.784	0	0	0	9	1	10
	C46	58.488	7	1	8	4	0	4
	C47	57.250	0	0	0	24	6	30
	C48	90.759	1	0	1	0	0	0
	C50	88.051	21	7	28	26	12	38
	C51	86.221	23	4	27	5	2	7
	C52	85.373	6	1	7	62	10	72

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	C53	81.230	8	4	12	8	0	8
	C56	75.391	0	0	0	11	2	13
	C57	73.442	1	0	1	25	4	29
	C60	71.060	1	0	1	12	0	12
	C61	82.292	10	1	11	8	0	8
	C64	80.841	17	2	19	16	4	20
	C65	80.400	17	3	20	5	0	5
	C68	80.518	19	11	30	6	0	6
	C69	82.502	11	9	20	4	0	4
	C70	82.935	7	0	7	6	1	7
	C71	76.848	14	5	19	3	0	3
	C72	64.353	16	1	17	42	11	53
	C73	49.068	10	0	10	44	9	53
	C74	42.576	2	1	3	14	5	19
	C75	23.156	1	0	1	11	8	19
	C76	0.815	0	0	0	0	0	0
	Total	3125.754	213	58	271	1902	238	2140